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Improving transparency and communication between focal company and suppliers

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Abstract

The objective of the thesis was to improve visibility and communication in the delivery process between a case company and its suppliers. The thesis was assigned by a company operating in the technology industry. The objective was to examine the company's current policies and find ways to improve the order-delivery process. The thesis aimed to find answers to the most important questions: What information was essential for both parties with regard to more reliable deliveries, what were the current problems in the order-delivery process and what could be done better?

The approach of the thesis was that of a qualitative case study with certain quantitative aspects. The qualitative methods were used when interviewing the case company's buyers and suppliers. In addition, the author's own experience and observation in the company were an advantage when identifying the current situation. The quantitative approach was used in collecting data from the company's' ERP-system to support the identification of the problems.

The identified problems were quite similar with the buyers and suppliers. The suppliers could not keep agreed buffer stocks, which resulted in incomplete and late deliveries. Based on the findings, this was caused by the fact that the case company could not give any continuous forecasts to its suppliers. Incomplete and late deliveries led the buyers to the common situation in which they used most of their time controlling orders, and this left no time for more important, strategic improvement tasks.

The thesis introduces solutions to the identified problems mainly by highlighting the fact that the companies should deepen their cooperation. In addition, also more concrete solutions were given, such machine-specific material needs and forecasts. The proposed solutions help the suppliers to understand the case company's operations better and they should be able to keep the agreed buffer stocks better. Because of the results, both parties have now more visibility to each other's situation, and this should help them to eliminate the earlier problems.

Keywords/tags (subjects)

Purchasing, material demand, material management, supply-chain, buffer stock, forecast, supplier cooperation

Miscellaneous

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Kommunikoinnin ja läpinäkyvyyden parantaminen toimittajien ja asiakasyrityksen välillä

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Tiivistelmä

Työn tarkoituksena oli parantaa asiakasyrityksen ja toimittajien välistä kommunikointia ja läpinäkyvyyttä toimitusprosessissa. Työn toimeksiantajana oli teknologiateollisuuden yritys Uudellamaalla. Tavoitteena oli määrittää yrityksen nykyinen toimintatapa ja etsiä kehitettävät kohteet, jotka liittyivät tilaus-toimitusprosessiin. Työssä vastattiin tärkeimpiin kysymyksiin; Mikä tieto oli tärkeää molemmille osapuolille, jotta tilaus-toimitusprosessi olisi varmempi, mitkä olivat silloiset ongelmat liittyen tilaus-toimitusketjuun ja mitä asioita voitaisiin tehdä paremmin?

Työn lähestymistapana oli laadullinen tapaustutkimus, jossa oli määrällisiä osuuksia. Laadullisia tapoja käytettiin haastattelemalla yrityksen ostajia ja toimittajia. Myös tekijän omat kokemukset ja havainnot yrityksessä auttoivat havaintojen tekemisessä. Määrällisiä tapoja käytettiin keräämällä tietoja yrityksen toiminnanohjausjärjestelmästä, jotka tukivat löydettyjä ongelmia.

Havaitut ongelmat olivat samankaltaisia niin toimittajin kuin ostajienkin keskuudessa. Toimittajien varmuusvarastot eivät olleet sopimuksen mukaisia, mikä johti jatkuvasti tilauksien myöhästelyyn ja jälkitoimituksiin. Tulosten perusteella tämä johtui yrityksen heikosta ennusteiden ja tarpeen määrittämisestä toimittajille. Jälkitoimitukset ja tilausten nopeuttaminen johtivat ostajat yleiseen ongelmaan teollisuudessa. Suurin osa heidän työajasta kului näiden ongelmien selvittämiseen, ja aikaa jäi näin vähemmän muille tärkeämmille kehitystehtäville.

Työssä esitellään ratkaisuja havaittuihin ongelmiin pääasiassa korostamalla yritysten välisen kommunikaation ja yhteistyön tärkeyttä. Myös konkreettisimpia kehitysehdotuksia laadittiin, kuten laitekohtainen materiaalitarve ja ennusteiden tekeminen. Esitetyt ehdotukset auttavat toimittajia ymmärtämään yrityksen toimintaa ja täten puskurivarastojen ylläpitäminen helpottuu. Ratkaisut auttavat molempia osapuolia näkemään toistensa ajankohtaisen tilanteen. Tämä parantaa tarpeen määrittelyä ja toimitusvarmuutta.

Avainsanat (asiasanat)

Hankinta, menekki, materiaalinhallinta, toimitusketju, puskurivarasto, ennustaminen, toimittajayhteistyö

Muut tiedot

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1 Introduction

1.1 Background information

This thesis was commissioned by a technology industry company located in Southern Finland. The company's turnover is around 130million €. The company manufactures and sells high-quality products to end users all over the world.

The theory background of the thesis concentrates on the purchasing operations and modern purchasing position in the company's business. The importance of purchasing and its impact on the company's processes are explained. Supply chain management and supplier relationships management as well as materials management are also discussed. The research part concentrated on the company's purchase orders and on the efficiency of purchasing. The theory information came from literature and the data in the research part was based on the author's own experience in the company as well as on information from the operative purchasers and one of the company's suppliers.

In addition to Enterprise Resource Planning software, the case company also uses other software for communicating with its suppliers. The other software has been acquired for the communication between the case company orders and suppliers. The software gives access to the suppliers to browse and confirm the case company's purchase orders. Moreover, the suppliers can add data into the system. All this information is then available to the case company's purchasers.

The case company is considering the addition of a new feature to this existing software or having a completely new program where information related to the suppliers buffer stocks would be visible and where the case company could give demand information or future demand forecasts to the suppliers. This would improve the visibility of the supplier's buffer stocks, which would also enable better control and management of the supplier's buffer stocks. At the same time the

suppliers could receive more accurate information about the coming demand, and they could prepare better for the future orders even before the actual orders are placed.

IT solutions like this are offered by many companies, but due to high acquisition costs, this system was postponed to be purchased later. Although the acquisition process will take place later, the information about what to share has to be investigated. In other words, what is the information that the suppliers want and what information is the most essential to the case company?

1.2 Aim of the thesis

The goal of this thesis was to find the main information that would be useful to the case company and the suppliers to share between each other. Moreover the objective was to find problems that hindered the data visibility between the case company and its suppliers. The third objective was to find improvements for the forecasts, which seemed to have rather high inaccuracy. Moreover, this study also examined the buffer stocks' levels. Finally, if this program is implemented later, the information that this thesis provides will expedite and help the future implementation process.

1.3 Current situation

The situation when starting this thesis was that the suppliers had agreed to hold a certain amount of the buffer stock. The related contracts there had agreements upon the minimum and maximum levels of stock items. Hence, the suppliers should always keep at least the minimum buffer available to the case company. The case company is obliged to purchase the buffer stock to the agreed maximum size. Usually the minimum size is one delivery batch.

Since some companies were known for their poor ability to deliver in time and deliver full orders, the case company wanted to have more real time information about the buffer stocks sizes. Late deliveries and lack of real time information from the suppliers' buffer stocks created a great deal of problems in the case company.

The visibility of the supplier's buffer stock would prevent backorders and prepares buyers to react to the suppliers' delivery/production problems earlier. New product implementations could be done with smaller scrap costs, and the timing of new parts could be done more efficiently.

From the supplier point of view exact or even suggestive demand forecasts from the case company are important so they could plan their production to meet this demand exactly and avoid under-or overproduction as well as big fluctuations in production, which could lead to the bullwhip effect. Finally they would be able to deliver materials in time with the right quantity. The big problem behind all this is the fact that the suppliers not always have the agreed buffer stocks at the delivery times, and the number of backorders increases. This again increases material handling and might even affect production.

1.4 Study method and main problems

The research method used in this study was a qualitative case study with some quantitative aspects. The study was implemented in order to improve the case company's and the suppliers' current situation, to eliminate incomplete deliveries and to provide better information to the suppliers about the case company's material needs. The current situation was clarified by interviewing the company's buyers and suppliers. In addition, the author's own experience in the company made it easier to identify its current problems. Uneven, late and partial deliveries create a great deal of extra work, and in order to confirm that this problem existed; the information about deliveries which had not been delivered in time was searched from the company's ERP-system. Moreover, the information received from the buyers and also from the case company's suppliers about the problem was essential when considering solutions to the problems.

As listed below there were a few bigger problems that were highlighted when confirmations about the problems were asked from the buyers:

- The case company does not give any continual, suggestive forecasts to the suppliers. The forecasts are only given intermittently and also the given forecasts are not at all accurate. The suppliers can enquire the future demand, or the case company will inform the suppliers about the coming demand, which leads to the second problem – lack of mutual language.

- Lack of mutual language. When the suppliers enquire, for example about the following month's demand, the answer from the case company is related more to one single production line rather than to one product group. The company uses abbreviations referring to production lines and shares this information with the suppliers. In the worst case the suppliers do not understand what the abbreviations refer to. The information should be something that both parties understand and that are related to single items rather than to production lines.

- Some suppliers do not keep the agreed buffer stocks and constantly deliver backorders and have late deliveries.

The results of this thesis should help operative purchasers who handle the daily purchasing activities, such as recalls, orders and delivery control. Furthermore, also the main suppliers who would be able to serve the case company better, could lower their inventory levels and lower the number of orders confirmed deviant, and, therefore deliver in time with full orders. This would decrease the workload from the case company's buyers, and they could concentrate on more important tasks, rather than on controlling the deliveries. Based on the findings from over 200 companies, 47% of work time is used in these routine tasks, such as recalls, delivery controlling and reclamations etc. By minimizing this time, the buyers would have time to focus on more strategic tasks. (Iloranta & Pajunen-Muhonen 2008, 90)

2 Purchasing

2.1 Classic and modern purchasing

The classical definition of purchasing is to buy the right amount of goods with good quality and to have them in the right place at the right time. In several companies purchasing is still a separate back office, whose main task is to acquire the right amount of goods to serve the production according to classical definition. This vision is strengthened by the fact that purchasing organizations mainly concentrate only on direct purchases. (Iloranta & Pajunen-Muhonen, 2008, 61) This can be described as reactive purchasing whereas proactive purchasing aims to ensure that new solutions are available to the company. (Sakki, 2009, 183)

The classical way to describe the purchasing process (Iloranta & Pajunen-Muhonen, 2008, 62):

Defining the need→quotation→choosing the supplier→ordering→delivery control→payment

The classical definition of purchasing aims to answer three main questions. (Iloranta &Pajunen-Muhonen, 2008, 62)

- What is needed?
- Where can it be bought?
- How much does it cost?

Van Weele (2010, 3) defines purchasing as follows:

> *Management of companies' external resources in a way that the supply of all goods, services, capabilities and knowledge which are necessary for running, maintaining and managing the company's primary and support activities are secured under the most favorable conditions*.

Today companies have a clear purchasing strategy which emphasizes skillful buyers and purchasers. They search parts and components from the markets that add high value to the product that the company is selling.

Iloranta and Pajunen-Muhonen (2008, 65) clarify that companies aim to create a competitive advantage by increasing their organization's bargaining power and by improving its suppliers. Purchasing is more and more connected to the company strategy, and purchasing is responsible for its part for achieving the company's strategy and targets. Purchasing eliminates all unnecessary and unprofitable added elements from the supply chain and from the purchasing process.

2.2 Strategic and operative purchasing

Purchasing can be divided into strategic and operative purchasing. Strategic purchasing maintains the supplier relationships, takes care of the business negotiations and finds suitable suppliers with suitable products. Operative purchasing is important connection between the customer enterprise and the supplier. It handles the daily recalls to the production lines, takes care and controls the delivery times and helps the others in issues that concern materials, such as reclamations. Procurement departments cooperate closely with quality, R&D and production departments.

2.3 Purchasing categories

Purchasing targets can be classified into direct and indirect purchases or they can be classified according to their financial significance. The thesis concentrated on the direct purchases, which are used to produce the main product.

Direct purchases

Direct or product related purchases are raw-materials and components used in the end products. A typical feature of direct purchases is that they are purchased continuously.

Indirect purchases

Indirect or non-product related purchases are materials that are used to maintain the operations. MRO purchases (Maintenance, repair and operating), such as office

supplies, chemicals, consulting and travel are part of indirect purchasing. Indirect purchases are usually around 30%-40% of the total purchases. (logistiikanmaailma.fi)

Investment purchases

Investment purchases are, for example, property and buildings or machines used in production. A typical feature of investment purchases is that they are nonrecurring, and that usually the purchase is relatively big. (Iloranta & Pajunen-Muhonen, 2008, 137)

2.4 Buying process

The buying processes in big companies follow more or less the same pattern. The work only includes buying -related matters, when in smaller companies the buyers might also have other duties and they handle the buying process alongside their main task. The following definition follows more or less the case company's buying routines:

The daily buying routine does not need much attention from the buyers, if everything works without problems. When the materials have reached the re-order point, or when a visual sign such as a kanban card tells to order more, the buyers will receive a signal through the company's ERP-system about the situation. The employee who has noticed the situation makes a new order using the RFID or barcode scanner, and the order proceeds to the buyer who will send the order to the supplier. The supplier should then be able to deliver the needed materials from their buffer stock. The amount and desired delivery date is generated automatically to save time. The remaining stock is sufficient to cover the demand during the lead time.

All the information about materials, such as the suppliers and delivery times are stored in the ERP-system. The dates and amounts can, of course, be changed, but this is not usually necessary since the ideal situation is that when a new batch arrives, the old one is nearly used. This aims to reduce capital tied to the inventory.

Too big inventories cause many direct and indirect costs. When the supplier receives the order, they confirm the delivery date to the customer using the software to which the case company and the suppliers have access. If the supplier cannot deliver the amounts in time, they confirm the order deviant and send an approximate delivery date with information regarding the situation.

As mentioned above, the basic buying routine itself is quite simple and takes only a small part of a buyer's time. The biggest part of the time goes to other routines, such as delivery control, stock control and dealing with different kinds of problems in the delivery process.

The suppliers receive all the necessary information about the needed materials and desired delivery dates with the purchase order. The suppliers are requested to confirm these purchase orders. If everything goes as planned, the materials arrive in time with the right amount. In practice things often work differently, which requires actions from the buyers. Figure 1 illustrates the buyer actions in the supplier interface.

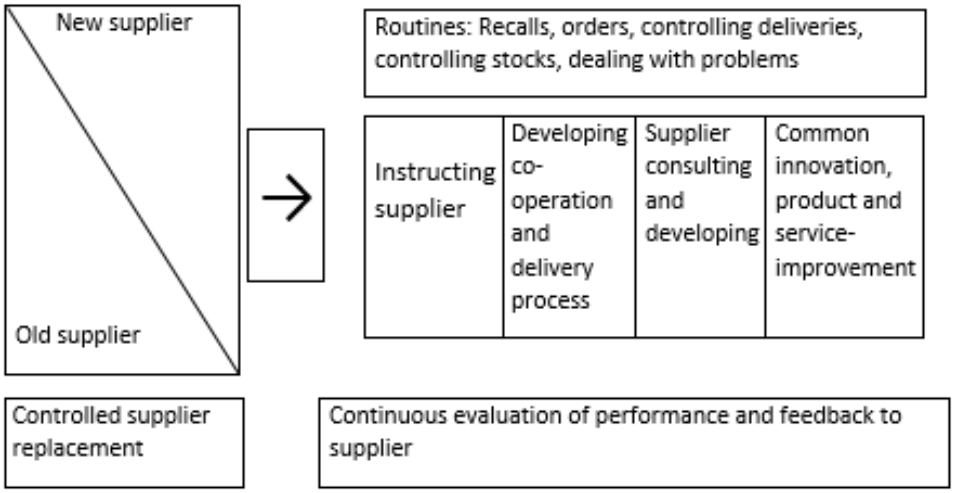

Figure 1 Actions related to supplier interface (Iloranta & Pajunen-Muhonen, 2008, .328)

Buyer involvement in the delivery process is needed if the suppliers do not confirm the order or if they deliver poor quality or cannot deliver in time. These problems, such as reclamations, problem solving, settling and pressing suppliers to deliver in time takes great amounts of time, which could be solved with better planning and

guidance. The better these problems are solved, the more time there is for more important and long-term tasks. (Iloranta & Pajunen-Muhonen, 2008, 329)

According to van Weele (2010, 43), there are three types of expediting that buyers can do. The first one is exception expediting where the buyer is informed that materials have not arrived in time. The buyer needs to take the right actions depending on the situation and consider if the late delivery causes disruption or a production shortage. This method is not recommended since the buyer always acts based on facts. A better way to do this is to use a preventive approach where the buyer contacts the supplier one or two days before the agreed delivery date and confirms the delivery date again so as to make sure nothing has changed. A somewhat more time intensive method is used for critical purchased parts and critical suppliers. In this method the buyer will check the progress at the supplier's end at regular intervals. This may even go so far that the buyer will place an inspector at the supplier's site. This method is known as "field expediting".

2.5 Role of purchasing

Most companies spend more than half of their sales turnover for purchased parts and services. Iloranta and Pajunen-Muhonen (2008, 86) says that according to the survey made by Kivistö, (Kivistö et al. 2005) direct purchasing costs in all companies are approximately 63% from the revenue. When including also the investments and all other purchases such as personnel the share grows to 86%. They clarifies that 72% of companies' purchases are related to production and 22% are not related to production and the remaining six percent is related to increasing capital and value.

Furthermore the fluency of purchasing affects to production and management costs and efficient and functional purchasing is essential to have and maintain good financial position. Neglect purchasing cause large amount of work, inspection and handling. Material shortages cause production reorganization and thus raise the production costs. In the worst case, material shortage could cause production and sales loss. Functional purchasing can support company's success by lowering the cost level and by improving production operations also by channeling supplier's

innovations for the good of customers business. (Lehtonen, 2004, 81)

Since such a big part of sales turnover goes to purchased parts, the purchasing processes should work the best way possible to avoid unnecessary problems or stoppages in the process. Nowadays purchasing is done mainly to meet the demand and supplier cooperation is considered very important compared to previous decades. Today purchasing as a strategic activity is highlighted and it is part of the company's strategic planning. Traditional purchasing is changing to supply network management and to external resource control. As a result networks have to be developed to meet the needs. (Karrus, 2001, 233)

In the 80's the purchasing were done to have big stocks regardless of the costs. Today the idea is different. The main idea is to buy right amount just for need. Getting rid of big stocks and buying small amounts just for need requires good relationships with suppliers, and when these relationships have improved, the amount of suppliers have decreased, since more and more parts are bought from same supplier. (Karrus, 2001, 233-244).

To achieve this newer method of inventory management and purchasing, companies have to improve and maintain supplier relationships more and have good purchasing management. Van Weele (2010, 11) highlights the purchasing management part and mentions that purchasing management has to control relationships and continuously improve purchasing processes in a way that supplier activities are aligned with the company's overall business strategies and interests.

2.6 Purchasing development

Today when companies maintain the focus on their core business and applies JIT and other efficient production management methods, the role of purchasing is getting more important. It is crucial that materials and services are at the right time at the right place.

Purchasing has changed significantly over the years. In past, purchasing managers had just one priority; cost reduction. Today the situation has changed to balancing

between cost, risk and value. When during the past years companies searched for the cheapest option and went for the lowest price to turn down local suppliers just to replace them with suppliers from low cost countries. Today this way of thinking is maybe decreased and suppliers are nowadays an important source of innovation. Suppliers are involved early in new product development processes, and so contribute large part of the new product development budget. (Van Weele, 2010, 55)

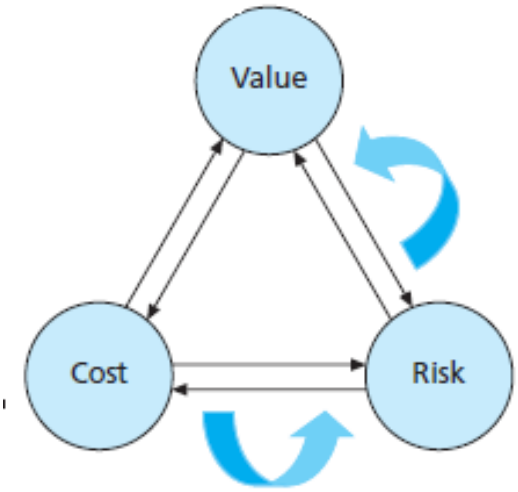

Figure 2 Purchasing agenda, balancing cost-risk-value. (Van Weele, 2010, 55)

As we can see from the figure 2 every three elements affects to each other and the decisions has to be made balancing between these three elements.

Today Purchasing is focusing more and more long-term strategic alliance and partnership away from the old habits where pressing the supplier for the lowest possible cost per unit was the main goal. Purchasing objectives usually relates to cost-reduction, product quality, and lead time reduction. Through these objectives company manages and controls purchasing activities and relationships with suppliers. (Van Weele, 2010, 63)

Traditional purchasing is changing to supply network management and to external resource control. As a result networks have to be developed to meet the needs. To improve your own purchasing processes, companies should include it improving the most important supplier's processes also. These two goes hand in hand and affects to each other. Different supplier evaluation and reward systems could lead the

supplier to desired direction. Also mutual development projects might strengthen the relationships and it gives more understanding to both sides. This should only be done with the most important suppliers, since it ties up lot of resources. (Haapalainen, Vepsäläinen & Lindeman, 2005, 223)

To get rid of unwanted costs, companies have to ensure that operations at their company are at the level so one can demand the same from suppliers. The contracts have to be clear enough and the purchase orders have to be clear and follow the rules stated in contracts. Forecasting has to be visible and accurate to give demand signals for suppliers.

Lehtonen (2004, 100) summarizes the importance of information well:

> *When supplier acts based on the information they get from buying company, the activity is as good as the information provided by buying company.*

3 Supply chain management

Supply chain consists of companies which take part to produce or deliver products to the end customers. The amount of participants varies and along with manufacturers and buyers/sellers it includes many contractors who do not own the product, but take part to deliver or store it. (Lehtonen, 2004, 104)

Supply chains are usually improved and optimized by expediting transportations, decreasing inventory and by allocating resources. IT solutions are also seen as an advantage when trying to have more precise planning and follow-up. (Haapalainen et.al, 2005, 123)

Today more and more company are moved from push-based production system more to pull based production system and the supply chain concept is expanded to value chain. The subsequent operations in the chain were wanted to see also as a

function that brings more value to the participants. When the participants started to focus more on their core businesses the chains have fragmented and shaped as a multidimensional collaboration networks. Actions of different participants affects to other participants in the chain. (Iloranta & Pajunen-Muhonen, 2008, 339)

Supply chain management should bring value to end users and all other users inside chain, with as low costs as possible. But since supply chains consist of many independent participants and all of them tries to optimize they own result, it is impossible to optimize the whole chain perfectly. The cooperation could happen evenhandedly when it is controlled by some strong part of the chain to make others understand the fact that the cooperation can benefit all participants. (Lehtonen, 2004, 104)

Iloranta & Pajunen-Muhonen, (2008, 340) states that the size of the company often determines the negotiation power and the ability to affect other participants inside the chain. It is hard for small companies to try affecting other companies and optimizing the chain for their good. Big companies can optimize the chain for their good, since the suppliers are strongly dependent from the main company success and change of direction. The buyer is globally so strong that the suppliers should be in the chain and develop the processes when the main goal is common growth and success. (ibid)

When every company maintains their focus tightly on core competence, supply chains are formed with smaller and smaller pieces. Every individual operation, delivery-, or value chain part can be executed in many ways**.** The complexity of operational environment increases inevitably. (Iloranta & Pajunen-Muhonen, 2008, 49)

3.1 Information and material flow

To be able to control supply chain, companies should be able to plan and control information flows. It is important to get the information of end demand to every part of the supply chain. The ideal situation would be that the whole supply chain would be steered by the real time demand by the end customer.

The biggest challenge in material flow management is to minimize the stock alongside the chain and shorten the lead time. When the stocks are small the materials flow fast through the chain, and thus improve the reaction. (Lehtonen, 2004, 114)

The main idea is to get rid of unnecessary stock to improve the efficiency of business. There is still some point where it is necessary to keep stocks. These are:

- Uncertainty→ safety stocks
- Variation in demand-supply
- Transportation stock

It is important to keep just as much excess stock as needed and intervene to the reasons which cause the need for safety stock. The most important ways to reduce supply chain stocks are:

- Improve supplier quality and reliability of delivery→Get rid of safety stocks
- Demand management and forecasting→Reduce the need for safety stocks because uncertain demand (Lehtonen, 2004, 116)

Interfaces between companies in supply chains are important. The decisions made in those interface affects other participants in the chain. It is common to do overlapping work, which could be avoided with better collaboration. Biggest part of the information flow is customer –and purchase orders, but information is still needed to do planning and forecasting. With the right information, companies could avoid unnecessary inventory and purchases and the work related for these. If the suppliers would know more about customers' situation, many error estimations could be avoided. The participants in the supply chain should improve their communication and information flow. The information is always two ways, but the main direction is from customer to supplier. (Sakki, 2009, 22)

3.2 Supplier co-operation

Fordism based mass-production was long prevailing way of thinking also in companies attitude against suppliers. The main assumption was that volume was the thing that affected to the price. Big orders were used to decrease the price and delivery expenses. At the same time the storage and handling costs increased. (Iloranta & Pajunen-Muhonen, 2008, 51)

Japanese auto industry pushed in strongly also to western industries and forced the western companies to concentrate to Japanese leading models more precisely. This way of thinking and the success of Japanese companies forced western companies to notice that they had different kind of approach to their suppliers. Japanese relationships to suppliers were long-lasting and interactions with them were plentiful and versatile. Developing suppliers were seen as a cost-effective and at least as effective as bidding. The quality was seen as a common objective and it was improved together. (Iloranta & Pajunen-Muhonen, 2008, 51)

Previously when companies bought big quantities, today they buy small amounts and maintain good relationships with suppliers. In recent years large international companies have spent a lot of money and resources to develop supplier partnership programs. One of the first ones in Europe who did this and named it “co-makership” was Philips. This co-makership aimed to building long term relationship with a limited number of suppliers based on mutual trust. (Van Weele, 2010, 221.)

This co-operation reduces four major costs and significant improvements can be achieved in:

- **Logistics.** By giving suppliers reliable forecast and insight into the supply need and material schedules, suppliers can anticipate much better to future requirements which then will lead more reliable deliveries and lower logistics costs for both parties.

- **Quality.** Early mutual agreement on quality policy enables zero defects in part inspection, which then enables complete deliveries and reduction in quality costs.

- **Product and supply chain costs.** To reduce suppliers underlying material, labor and process costs, companies should have detailed understanding of the suppliers and the industry cost structure.

- **Product development.** By taking suppliers along to new product planning or development processes. Time-to-market and start-up costs may be reduced. (Van Weele, 2010, 221)

Especially first two points are important in this specific case and significant improvements and savings can be achieved with more visible supply chain and better forecasting/information sharing. Especially the first point summarizes the point why it is important to give reliable forecast to supply need.

According to Van Weele (2010, 221) Ellram and Hendrick (1993) have made a research of partnership in 1993 and they used the following definition to partnership:

> *Partner is defined as a firm with whom your company has an ongoing buyer-seller relationship, involving a commitment over an extended time-period, a mutual sharing of information and a sharing of risks and rewards resulting from the relationship.*

Based on this definition, researchers concluded that less than 1% of the total of supplier relations could be defined as partnership relationships.

Partnerships are costly to implement and requires extra communication and risk sharing. Many partnerships fail to deliver value and are justified only if they stand to yield substantially better results than the firms could do without the partnership. It takes lot of human resources to form tight relationship with every supplier, and it should only be done with main suppliers. (Lambert D & Knemeyer M, We’re in this together)

One example of good partnership and the results it enables when done correctly is from car business. Big car manufacturers have the resources and time to steer and control suppliers much better than smaller companies, but the guidelines are simple and everyone can follow them more or less. Some guidelines can be taken and implement also in smaller companies.

Car manufacturer such as Honda commands its engineers to supplier facilities to lead kaizen (continuous improvement) events. These events take 13 weeks when other automakers devote only one day to a week to developing suppliers. These events aim to create a model of production line to supplier's factory. The goal beyond technical consulting is to open communication channel to supplier and create supplier relationships. The engineers stay in touch with suppliers long after returning from these events. Toyota in turn teaches its suppliers to its famed Toyota Production System to help manufacturers and suppliers learn together how to improve operations. Honda's system increased suppliers productivity by about 50% improved quality by 30% and reduced costs by 7%. (Liker & Choi, Harvard business review, building deep supplier relationships)

This requires lot of effort and resources from the company, and is worthwhile and reasonable to do only with suppliers who are your main suppliers, with large volumes. This system and way of improving things benefits both sides; the reduced costs become the baseline for new contracts and suppliers can apply what they have learned to other product lines and keep all the cost savings. (Liker & Choi, Harvard business review, building deep supplier relationships)

Toyota and Honda don't take hand-offs approach to deal with suppliers; they think supplier's roles are too vital for that. They use elaborate systems to measure the way suppliers work. One way to give feedback to supplier is to write them a short report of their performance. Honda for instance, uses report card even to their third-tier suppliers. Most companies send reports to suppliers annually or biannually, but Honda sends reports to suppliers' top management every month. Typical report contains six sections: quality, delivery, quantity delivered, performance history, incident report and comments. The incident report section has a subcategory for

quality and another for delivery. Comments field can be used to deliver performance information for supplier. (Liker & Choi, Harvard business review, building deep supplier relationships)

This information could be easily transferred from ERP system to excel and then perform a short and clear report to supplier and to employees in your company. This gives clear and fast perception to suppliers past month activity and performance.

By performing regular control to suppliers activity enables company to see how well suppliers perform and gives concrete facts where to focus. The simplest way to follow and analyze suppliers is to take single delivery under control and check quality, quantity and delivery time. The more important supplier is the more benefits it brings to analyze supplier more deeply which finally enables company to give guidance and tools to control the supplier to right direction.

4 Materials management

Material management is part of the companys and whole supply chain process steering. It aims to speed up the lead time and try to ensure the availability of purchased materials. The idea is to do this in optimal way so the workload would be small as possible. The material management goals is related to productivity of work and capital, and efficient use of space.(Sakki, 2009, 115)

This chapter contains basic features and problems related to material management. Also production management is reviewed shortly, because it is related to materials management and to the current problem in case company. The following subtitles includes case companys material management principles and the way case company steers and manages its material flows. This information is essential to understand and to be able to assimilate the material management importancy to case company production, and the risks it generates when suppliers cannot deliver in time.

4.1 Order Penetration Point

At case company the Orders are placed to suppliers stock, hence the OPP is supplier's stock. If companies need fast deliveries and cannot stand long lead times, new orders are directed to suppliers stocks. This method enables fast deliveries. OPP (Order Penetration Point) is the point where demand (order) is targeted to the concrete product. The place of the OPP affects both to costs and the benefits. The closer the OPP is to the customer the faster deliveries suppliers can make. This method creates more costs for supplier since they need to have larger stocks to be able to serve customer. Moving the OPP from suppliers stock towards supplier's production increases the delivery time, but improves the flexibility of production. (Iloranta & Pajunen-Muhonen, 2008, 359)

4.2 Just In Time

JIT-Just In time is a methodology which aims to reduce inventory and optimize the batches. Inventory is seen as a waste and the materials are wanted to be in the right place at the right time and available just when needed. (Van Weele, 2010, 260) All the waiting time is unnecessary and seen as a waste of capital. The faster material and information flows the less are the expenses and tied-up capital (Iloranta & Pajunen-Muhonen, 2008, 348)

JIT can be summarized to word pull-system. It is a production method where work-in process inventories are reduced because the goal is to manufacture just the right amount of products just when needed. (Sakki. 109) the spare time is used to some other small repair works or improvement of the production line etc. So the time is not used unproductively. (Van Weele, 2010, 260)

One of the benefits and characteristics of JIT-system is related to quality awareness. Smaller batch sizes makes it necessary to detect quality defects in time, and employees are instructed to handle the defects right, so no other parts can make it to the production line. (Van Weele, 2010, 260)

JIT has a major impact on both the quality and the quantity of the materials to be purchased. Ordered materials are delivered maybe even several times a day and maybe even straight to the production line.

4.3 Kanban and two bin system

Two bin system is very practical way to manage material flows. It is suitable for products that have constant demand. Two bin system works in very simple way. When one box is empty new order is made, and the other box has the amounts to cover the need during lead time. Two bin systems can be changed for example three bin systems where the last bin is at the suppliers premises waiting to be shipped.

Kanban is a term for cards, which are used to control material flows. In Kanban system the cards have big role. The cards are used to notify people that more items are needed in production or new order is needed. (Merikallio & Haapasalo, 2009, 21) The word Kanban comes from Japan. Kanban is a control method in Just-In-Time principle. It helps to specify what are needed to produce and in what amounts.

4.4 Vendor Managed Inventory

VMI-vendor managed inventory is procedure which has become quite common in industries. In VMI suppliers products are stored in customer premises. The ownership is passed to customer when the customer needs the items or the supplier invoices customer by consumption. (Sakki, 2009, 131) This is the basic idea of VMI, but there might be rules and contracts inside parties that for example customer has to acquit the items in VMI after some period of time.

The benefits from VMI are that customer does not need to tie capital to goods before they are used and suppliers can monitor the stock levels better and plan production according to the usage of VMI stock. The delivery time is nonexistent if the VMI is located at customer premises. Moreover supplier can deliver item in one batch rather than several times a month. Although the monitoring and other tasks related to VMI increases the supplier expenses, VMI have more benefits than expenses. (Sakki, 2009, 131)

According to Kaipia, Holmström and Tanskanen (2002, 3) Waller et.al (1999) investigated impacts of VMI a lot and the results show that by replacing purchase orders with inventory replenishment enable suppliers to improve service while reducing supply chain costs. The reason is that average product was reviewed more frequently than purchase orders were placed before.

4.5 Bullwhip effect

Bullwhip is very common phenomenon in industry. It happens when demand variation increases and moves up the supply chain towards the upstream. Small changes in end user might be much bigger in the upstream. This originates from the fact that the companies cannot predict or forecast the variation, and when the reaction is slow the inventories varies a lot which creates bullwhip effect in the chain. The bullwhip effect can be seen as a disturbance in a supply chain. Excessive variation causes extra warehousing, inefficiency in transportation, bad service and troubles in production planning. This creates extra costs in every part of the chain. (Iloranta & Pajunen-Muhonen, 2008, 354)

Biggest reason of bullwhip effect is the lack of information flow and the wrong information along the chain. The information is kept inside own company, because of the competition situation. Production and inventory information are kept inside own company and defined as a strategy information. The visibility of this information would reduce the capacity problems, unnecessary warehousing and availability problems in different parts of the supply chain (Haapalainen, et al. 2005, 146)

Bullwhip effect can be seen as a result of four different phenomenons. It is supported by 1) slow update of demand forecast (Forrester phenomenon) 2) Join purchases for one big batch (Burbridge phenomenon), 3) the more orders is made the more reliable the chain is (Houlihan effect), and 4) overreact to price fluctuation. (Iloranta & Pajunen-Muhonen, 2008, 354)

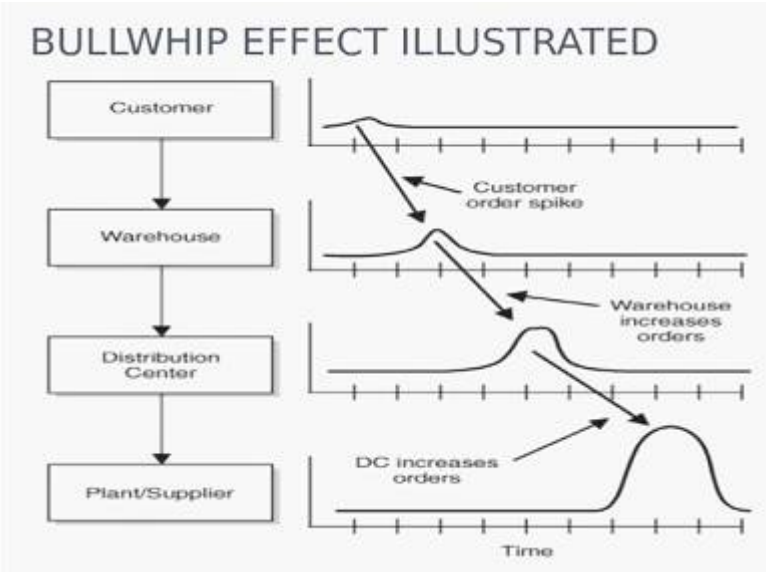

Figure 3 Bullwhip effect illustrated (Mitra A, 2013)

4.6 Decreasing the bullwhip effect

Best way to decrease bullwhip effect is to extend the visibility of customer demand as far as possible, so the orders meet demand exactly. This is not always possible so also other methods such as VMI and production leveling are needed.

In consumer markets best way to decrease bullwhip effect is to give the replenishment responsibility for supplier. This Vendor managed Inventory along with other improvements such as continuous replenishment program companies have achieved 25% savings in inventories. Furthermore also by lowering batch sizes bullwhip effect can be reduced. (Haapalainen et al. 2005, 152)

4.7 Production leveling

Production leveling or by its Japanese original term heijunka is a technique that aims to reduce waste in production and meet demand better. It's a technique for reducing the Mura (unevenness) which in turn reduces Muda (waste).

Case company is using heijunka to be able to anticipate better to fluctuations in production and minimize inventory and manpower and maximize efficiency. The idea of production leveling is that same products are not necessarily made all in once, in

large batches. The production is organized in a way that divergence in production between different products is leveled in production. Production leveling makes it easier for suppliers to work, since the demand is constant and suppliers can utilize the machines and workforce more efficiently when the amount of products stays constant. (Merikallio & Haapasalo, 2009, 19) This in turn decreases the possibility to bullwhip effect.

5 Forecasting

Forecasting plays a big role in today's industry. Failed forecasting in industries creates excess of some products and shortage of others. The early and accurate information in supply chain provides enhanced ability to synchronize planning and execution and therefore provides the potential for numerous, substantial benefits. (Fliedner, 33)

Many companies do not know their future demand and therefore are not able to give this demand further to chain. This makes the decisions harder in sourcing, production planning and in inventory management. Accurate forecasting offers great cost savings in company when company could work with lower inventory levels, stock outs could be disposed and resources could be used better inside the company. (Kerkkänen, 2010)

Companies are often balancing and anticipating to inaccurate forecasting by having more inventory than may be needed. This way of acting stands a way of JIT principles and company have to balance between inaccurate forecasting and JIT principles and optimal stock size.

Kerkkänen (2010) describes forecasting as follows:

> *Estimation to a future event or condition which is outside an organization's control and which provides a basis for managerial planning. Forecasting techniques range from*

simple to complex and can be used in sales, purchasing, inventory etc.

5.1 Forecasting based on figures

The purchasing personnel usually have the information about previous month's consumption history. By using this information buyers can calculate the average consumption from previous months and along other information are able to estimate the future demand. Based on the history consumption one can also calculate consumption forecasts with the help of mathematical formulas. The idea behind them is that future demand is based on or follows more or less the previous demand. (Sakki, 2009, 135)

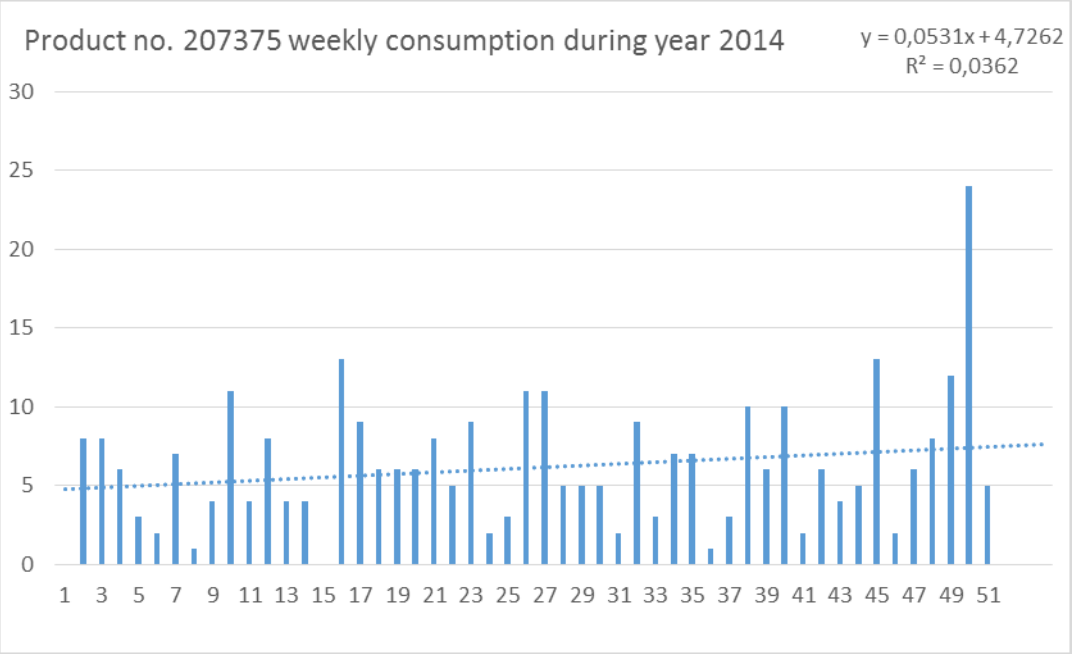

Figure 4 product no. 207375, weekly consumption

In the figure 4 the columns present the weekly consumption of one case company material and the line represent the time series trend line. The formula in upper right corner represents the trend formula. Next week demand can be predicted by using the formula. R^2 is so called coefficient which tells you the probability for the forecast.

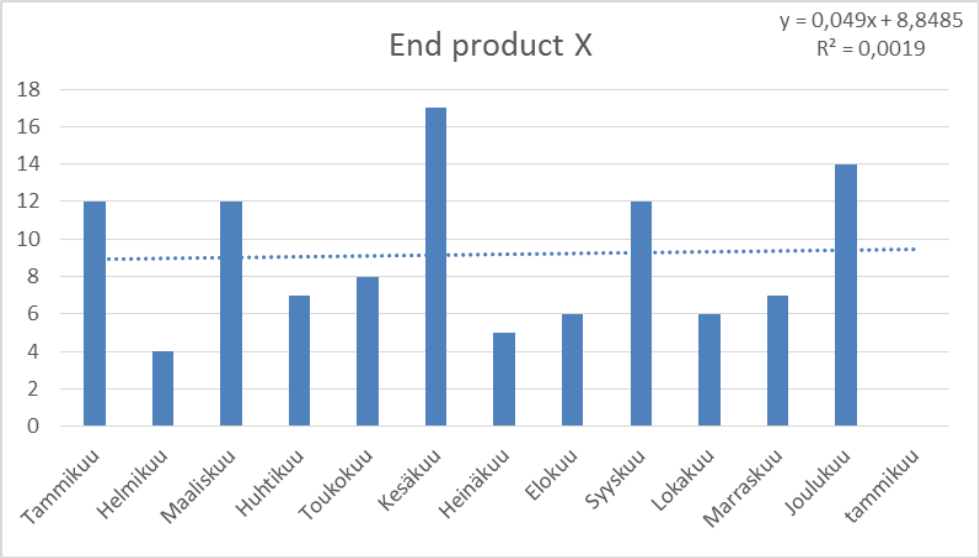

Figure 5 One end product monthly sales during year 2014

Forecast for single material is not probably the most efficient way and it is reasonable to do it only for materials that creates the most problems. More efficient is to do the forecast for one end product and give this information further to chain. Of course the supplier then has to have the information what materials are needed in that specific end product. The material demand for certain end products is reviewed later in this thesis, and solutions for it are given.

When forecasting demand varies, the time series should be refined. One way to do this is to change the time series to difference. Meaning that instead of original perceptions, two subsequent perceptions and the difference between these two are used. (Sakki 2009, 137) This is illustrated in the figure 6. This procedure demonstrates the variation of the demand.

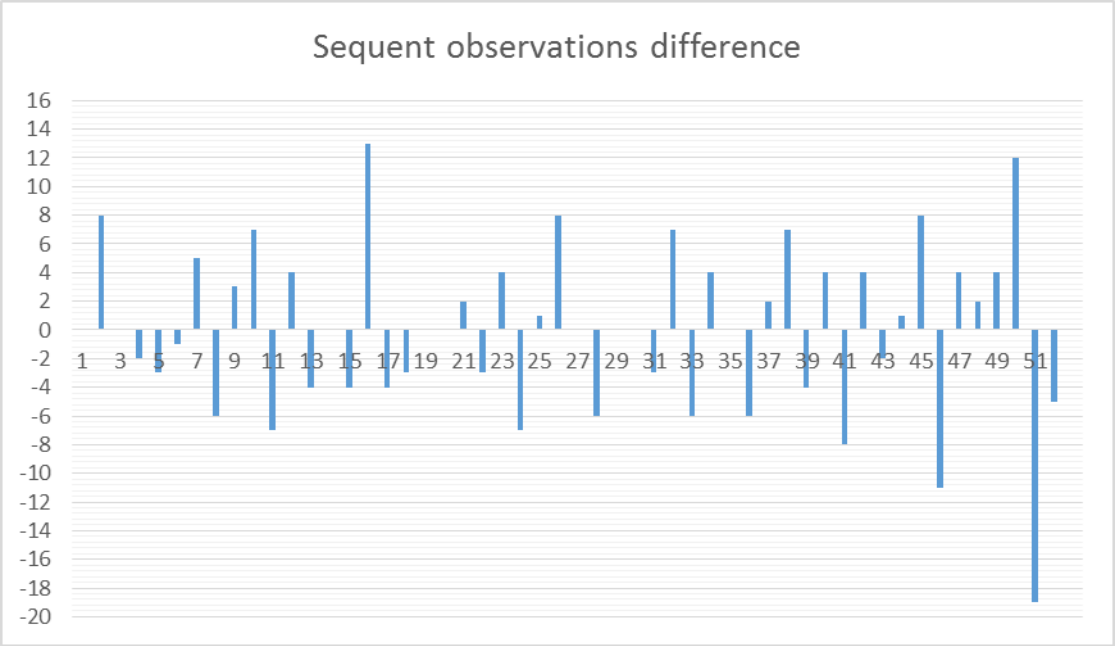

Figure 6 Two subsequent week consumption difference

If the consumption varies randomly against the average with the methods explained above, the best way to predict future demand is to calculate the average. Other option which is a bit more advanced is so called moving average. Moving average is calculated from agreed amount of subsequent numbers in time series. For example by calculating the last four week average consumption and keeping this as a forecast to the next week. When time goes on and the real demand is known, the last number is deleted and the new real number is taken to the forecast. These numbers are again used to calculate the new forecasted demand. (Sakki, 2009, 137)

Other simple way to form a forecast is called exponential smoothing. New forecast=Previous forecast+α *(Previous period consumption-previous forecast to same period) the earlier periods impact decrease exponentially and that's why this method is called exponential function. The coefficient α is some number between 0 and 1. (Sakki 2009, 138) Mathematically this same formula is represented as follows:

$$E^t = E_{t-1} + \alpha(X_{t-1} - E_{t-1})$$

The alpha can be any number between 0 and 1. Low alpha (0.1-0.15) is suitable for steady situation and high alpha (0.3-0.5) is suitable for seasonal products.

Exponential function is really useful, since it needs only previous forecast and previous period consumption along with alpha. (Sakki 2009, 138)

5.2 Forecast approaches

Forecast can have many approaches. Usually forecasts are produced based on historical data and they aim to anticipate to future demand. It is easier and more important to forecast bigger entirety than small units. (Product family forecast is important than single unit) Near future forecast should be more accurate than long-time period forecast. In most cases monthly forecasts are used and completed with more accurate weekly forecasts. (Lehtonen, 2004, 108)

The accuracy of forecast can be measured in many ways and it measures the functionality. The most common indicators are Mean absolute percentage error (MAPE), Mean absolute deviation (MAD) and Mean error bias. These methods can be used to follow the demand forecast function. (Lehtonen, 2004, 109)

Kerkkänen (2010) mentions that in forecasting literature, much of the focus has been on forecast methods, sources of forecast error, and reducing the forecast error. “Despite the advances studies have shown that forecasting sophistication, forecasting performance and satisfaction with techniques, systems or management processes have not improved in recent decades. Kerkkänen (2010) mentions that more focus should be pointed to managerial side of forecasting to develop tools to support managers in developing the forecasting process.”

The Planning information is based on long-time period demand forecasting. Based on this both buyer and supplier prepare in advance to fulfill that planned production. Based on the planned information companies creates preparedness to reserve capacity and buy long delivery-time parts. Because the planned production is based on demand forecast, it is also necessary to prepare divergent production. By doing the forecast accuracy measures companies can predict the scale of fluctuations. (Lehtonen, 2004, 99)

In reference to figure 7 buyers could send regularly one forecast program where are mentioned fixed -variable and forecast periods. Fixed period can be for example three weeks and variable period three weeks. It can be decided that buyer is committed to buy fixed period demand and there will not be any changes afterwards. The variable period demand can be still changed, but there can be agreement that it will only change 50%max or so. The forecast period engage neither part.

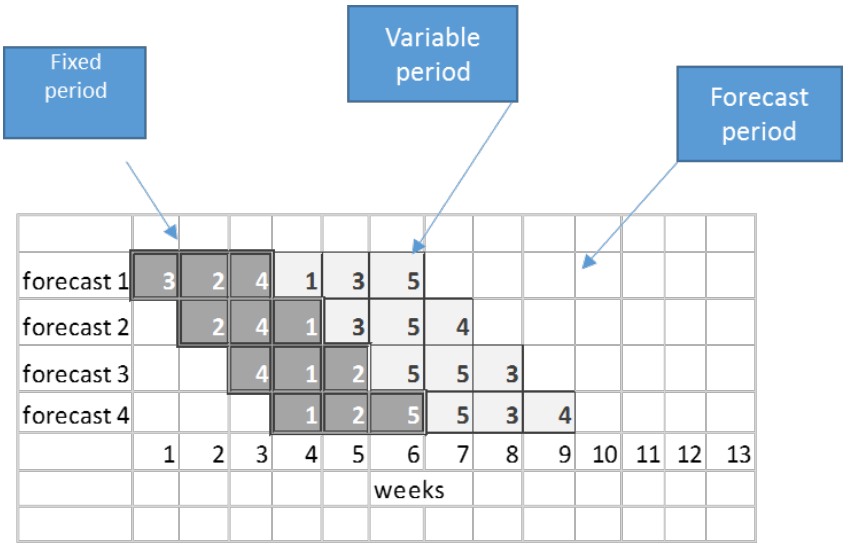

Figure 7 forecast program (Lehtonen, 2004, 99)

5.3 Forecasting at the case company

Planning process is proactive process, which enables companies to prepare future operations. In practice this means forecasting and planning. Demand forecasting is essential since many other activities are based on forecasting. In this thesis the most important forecasting is related to materials. The timespan of material forecasting depends on two things; what is foreseeable in general and what is critical (materials delivery time and production capacity) (Lehtonen, 2004, 107)

The current situation in the case company to forecast the demand was done in very primitive way, if done at all. The future demand was only done for the busiest periods with a simple form, which contained every different end product categorized just by name. The problem was that the information did not contain information in material level. There was not information available for the suppliers how many

pieces of certain part are needed to one single end product. This generated problems in both at case company end and also at suppliers end. The idea behind this was great, but the execution was in halfway, since the suppliers did not know the exact demand for single part. This would have been the most important information for them.

Fortunately the case company production is quite steady which enabled suppliers to prepare future demand quite well. Of course this was not the best way to act, and at the same time require good deliveries and full buffer stocks from the suppliers.

Lehtonen (2004, 108) mentions that forecast in material level can be done in two different ways depending its relation to raw materials and to end products. The first method, where large scale of materials are used to assemble small amount of end products (E.g. automotive industry) In this method the material demand can be calculated by the sales forecast, when the end product demand is known and product variant percentage is known. In the other method where small amount of raw materials are used to assemble multiple end products, forecasting is not usually needed in materials level, but end product groups level instead. In this method the material demand can be calculated by the amount of end product forecast. The case company could be categorized to the method introduced first. If concentrated to one assembly line, there are large scales of raw materials and the amounts of end products are relatively small.

Problems with forecasting in the case company have already discussed and the lack of appropriate forecast method was one reason why stock shortages and late/incomplete deliveries occurred. It was essential to focus on that problem and make a directional guideline how this problem could be solved and what kind of methods could be used to give at least some information to the suppliers about coming demand.

As mentioned in the previous chapter, many companies spend lot of money to develop or select ready-made computer software for preparing the forecast. Common conclusion was that with good software comes good forecasting, when the

reality has shown that sometimes even expensive implementation have failed to bring accurate forecasts. This is partially true, but when the information behind the forecast and the control and monitoring of it are done correctly, it could bring lot of savings and benefits for both customers and suppliers.

One big problem which complicated the forecast accuracy in the case company was the production plan and the big possibility to the fact that it will change constantly. Since there was no forecast which would be based on estimated sales, but the production plan was based on sold devices. Production plan was done according to sold devices and according to the date customer wanted the device. The production plan variability means that when production planning have already been made for some week, it might still change and some other products were placed in the middle of that plan in a few days' notice to replace or mix the original plan. This arose from the fact that some devices was sold in a short delivery time.

If forecasts are sent by this to supplier the result might be that the suppliers interpret this information wrong, which distort the actual need and eventually this could lead even to a bullwhip effect.

6. Purchase analysis

Analyzing suppliers and their performance is needed no matter how deep the relationship is. By controlling suppliers regularly, company can see how good suppliers are performing and operating. Although many companies have some kind of assessment for suppliers, they might not still use and maintain it enough and will not take full benefit from it. The worst thing is that if companies will not react to poor supplier performance. This allows suppliers to continue their bad performance and they see no reasons why to improve their processes. By continuing like this companies fail to use this as an advantage in negotiations and in the worst case they stick with the bad supplier. Without feedback suppliers will not change their behavior and if there's no clear procedure to how to react to these situations companies will not get rid of bad suppliers. (Iloranta & Pajunen-Muhonen, 2008, 336)

Table 1 illustrates the relationship with suppliers and the scope of controlling and measuring when the relationship becomes more important.

Relationship with supplier	Scope of controlling and measuring
simple and nonrecurring supplier relationships	fullfillment of basic goals (quality, quantity, timing and other indicators or operative processes)
Longer and more complicated relationships with suppliers	attitude to problems and ability to solve the problems. Continuous development.
long-term relationships which includes mutual development	Continuous cost-level reduction. Development of mutual processes.
long-term, mutual planning and innovation involving relationship	mutual innovations and technical development. Capability and resources development that aims to have mutual goals

Table 1 supplier performance control and monitoring dimension when relationship is growing and become more important (Iloranta & Pajunen-Muhonen, 2008, 337)

The supplier evaluation system is usually related to operative purchasing efficiency and direct service level evaluation. The evaluation systems are known to be harsh and instead of using positive evaluation, companies use evaluations which highlights negative performance, such as reclamations and late deliveries. Harsh evaluation systems and the lack of them has been the reason why purchasing activities has been underrated. Although purchasing includes lot of cost savings, but the evaluation methods and the previously mentioned harsh tools to evaluate it has been seen as disadvantage to it and companies cannot take full advantage from it. (iloranta & Pajunen-Muhonen, 2008, 431)

6.1 Purchasing evaluation

What is performance and more precisely what is purchasing performance and how to measure it? Iloranta & Pajunen-Muhonen (2008, 343) says that purchasing performance evaluation as a quantitative and qualitative assessment which has been made in certain time-span based on the facts how well purchasing department has helped the company to achieve its operative and strategic goals.

Follow-up and evaluation aims to give information about the processes and its improvement potential that it have in a clear and compact form. It should show that processes include problems and parts that should be improved. Follow-up should also help identify trends and changes and it should give clear picture about the desired outcome. (Iloranta & Pajunen-Muhonen, 2008, 435)

6.3 Purchasing amounts

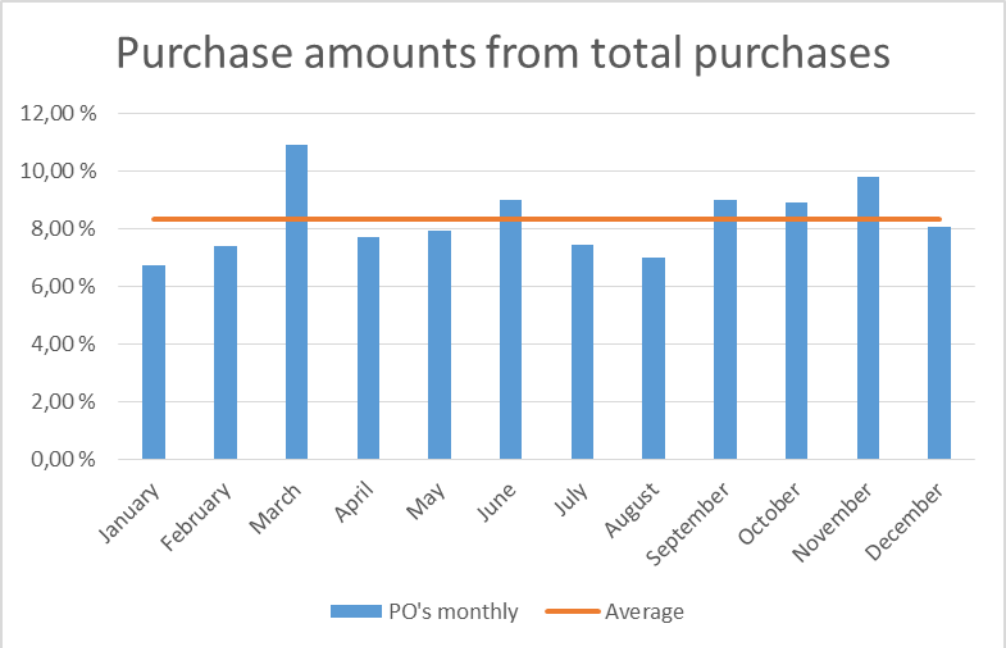

Figure 8 Purchase amounts from total purchases

If we look at the purchase order amounts made during the year 2014, we can see that the purchases have divided quite evenly. The summer period alongside early part of the year have been a bit quiet than the other months and March have been busier than other months. The average purchase orders made during month was

2614 pcs, which were 119 orders in a day. The peak in June and then more quiet months are explained that due to supplier's holidays, the stocks were filled in June to meet the needs during supplier holidays, which were in July and in August. The amount of purchase orders is increasing again towards the turn of the year.

Amount of purchase orders has been quite constant, which has made it easier for suppliers to predict the demand. As mentioned already before, most of the suppliers do not get any kind of forecast from the case company, but they have to predict the demand, for example based on the history data.

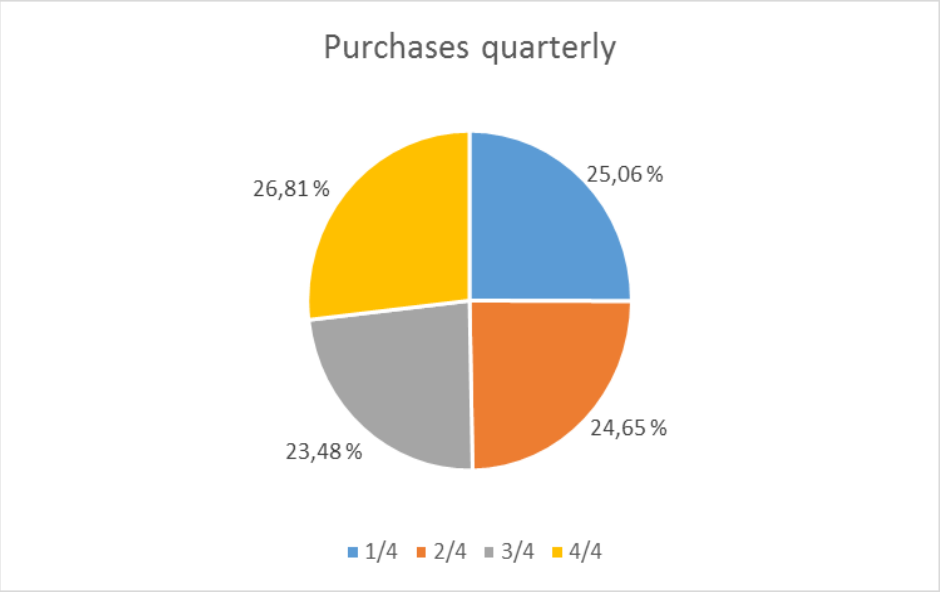

Figure 9 Purchases quarterly

If we study the purchases quarterly we can see that the amounts are quite the same. End of the year seems to be the busiest time while summer time is the quietest.

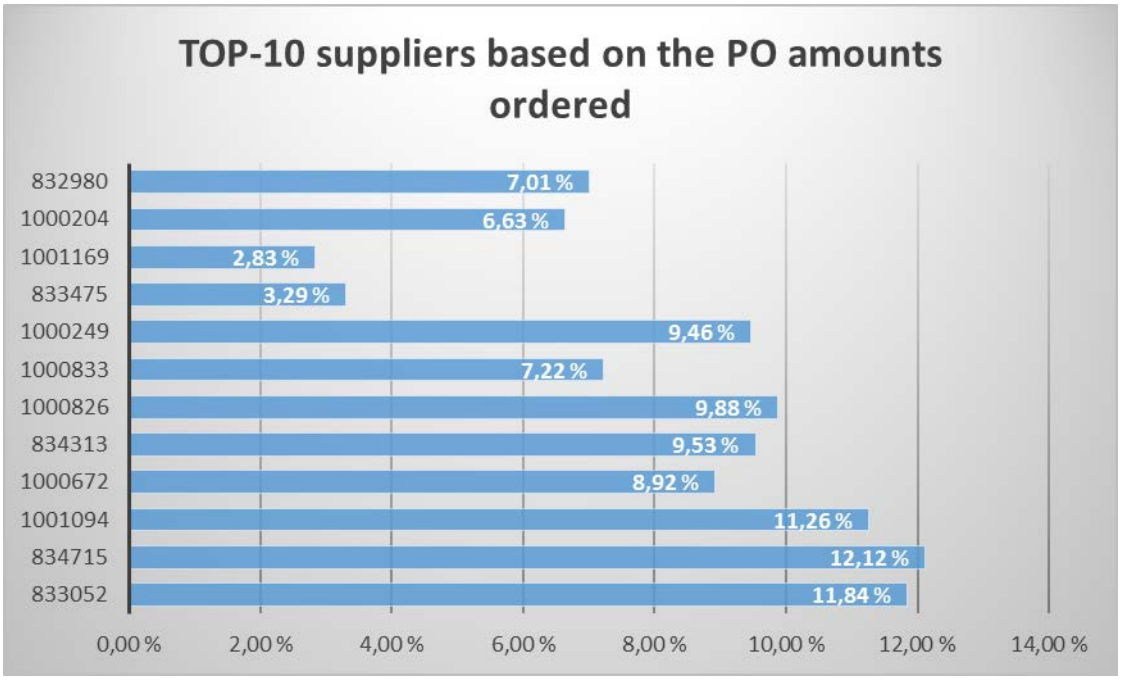

Figure 10 Top-10 suppliers

Case company has approximately 200 active suppliers and above is mentioned 12 biggest suppliers, measured in purchase orders. These twelve suppliers received 1050- 1300 orders monthly, when the average amount of orders case company sent in a month was 2614. These twelve suppliers then received approximately 45% of the total purchase orders. Some suppliers might deliver more items quantitatively than above mentioned twelve suppliers, but they are rejected, since these twelve deliver more important items and the amount of purchase orders are the largest for them and hereby are more important to case company.

Two biggest suppliers are excluded from the lists, since one of them was supplier with VMI stock and therefore distort the readings, other one was supplier who delivered painted items to the case company machine shop and therefore is not needed in these figures.

These ten suppliers are the ones that case company should invest in and try to mutual understanding of common policy. There are still suppliers which did not fit in this table and deliver important items to case company, and of course these suppliers are also important as are everyone. But the line has to be drawn somewhere. It is impossible to manage 200 suppliers with same resources.

6.4 order confirmation

When the five biggest suppliers were selected and the orders they have changed due to production problems or other problems were studied, we saw the problems and reasons why case company needed new system and more visibility to the suppliers processes.

By examining these suppliers more closely, reasons why delivery dates was changed and why they have not been able to deliver in time were seen. The examined time period was 1.1.2015-31.3.2015.

Supplier A (1000672) had around 140 active items which they delivered to case company. This supplier delivered 353 orders between 1.1.2015-31.3.2015. 39 of these orders were confirmed deviant. This was 11% from the total orders. If one day delays and part deliveries are excluded from that number the amount was only 12 orders and 3.8%. One day delay usually don't stop the production and part delivery is better choice than two or three days delay, since the supplier is able to deliver part of the delivery and delivers rest of the order later. As the figures show, this supplier has performed quite well. Although the one day delay will not stop or cause any delays in production line, it might still create extra work to buyers, whose responsibility it is to control delivery times and make sure that production work with sufficient materials.

If instead supplier B is studied (1000833) different kind of readings were found. This supplier had around 130 active items. Between 1.1.2015-31.3.2015 they delivered 314 orders and 80 of them were confirmed deviant. That was 25.5%. If again one day and part deliveries are excluded from the list, the figures were 12 and 3.8%. If only 1 day delay is taken away from the readings, the figures were 39 orders confirmed deviant which were 12.4%.

As can be seen, one day delays and part deliveries was quite common among the deliveries. Either the delivery time have been agreed to be too short or the supplier production cannot deal the orders case company sent, or with most cases, the

supplier does not have the agreed buffer stocks. If they would have enough buffer stocks, they would have been able to deliver items inside the wanted delivery time.

Although it is good that suppliers can deliver part deliveries instead of having over one day delays, but this increases the work in inbound, material inspection and in warehouse. Also the logistics costs increases. Already congested inbound area gets even more congested when deliveries are delivered in two or three batches rather than all at once. This increases the movement of items from inbound area to warehouse. The possible inspection is also done in several parts rather than all in once. When materials arrive in multiple deliveries, employees in inbound are need to pay extra attention to these materials. Make sure not to re-order them, because they have not arrived entirely, fill the stocks twice and move items from warehouse to production line maybe several times due to part deliveries.

When the visibility increases and suppliers starts to get information also from case company inventory levels, these part deliveries could be reduced and eventually get rid of them entirely. If the supplier could see customer stock levels or customer could inform the suppliers that they have sufficient inventory and will not need the part delivery, is it even necessary to send the part delivery rather than wait until the whole batch is ready and send all in once. This would reduce the logistics costs and the handling costs in both sides.

Supplier C (834313) had around 88 active items and in time period 1.1.2015-31.3.2015 they received 536 orders. 98 of these orders were confirmed deviant, which is 18.3%. When one day delay and part deliveries were excluded 29 deliveries was confirmed deviant which were 5.4% from total orders.

Supplier D (834715) had around 132 active items and in time period 1.1.2015-31.3.2015 they received 493 orders. 63 of these orders were confirmed deviant, which is 12.8%. After excluding the part deliveries and one day delays 22 deliveries were confirmed deviant which was 4.5%.

Finally supplier E (1001094) had 270 active items and in time period 1.1.2015-31.3.2015 they received 421 orders. Only 21 of these orders were confirmed deviant

which was 5.0%. Excluding the one day delays and part deliveries we got only three orders which is only 0.7%. This supplier activity has been very good, although it has several orders confirmed by smaller amounts than were originally ordered.

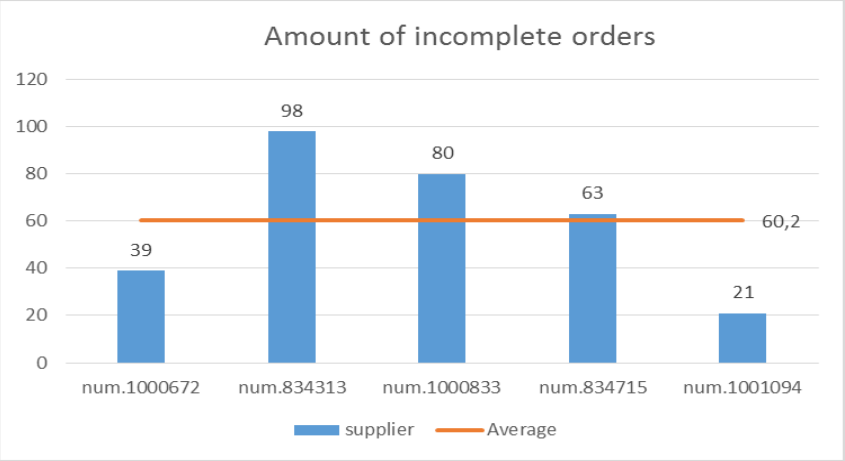

Figure 11 Amount of incomplete orders (1.1.2015-31.3.2015) including part deliveries and one day delays.

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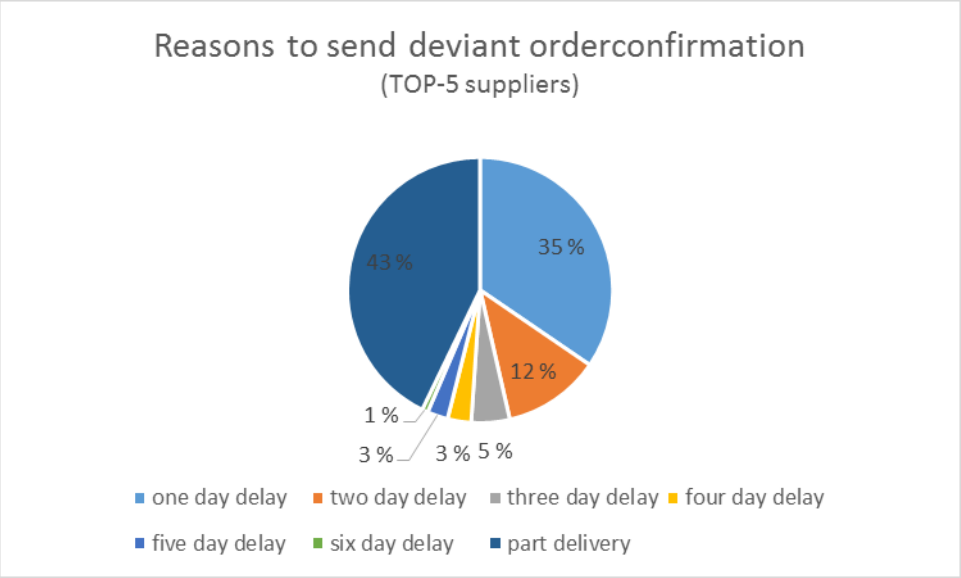

Figure 12 Deviant orders

As seen from the diagram, biggest reason why the suppliers have confirmed orders deviantly was one day delay and part delivery. The suppliers received 2109 orders during January 2014 including all suppliers. the amount of orders confirmed deviant were 183. This is 8,3% and in February the percent was 10,7%. The readings are very high and the amount of work hours and sorting this has required is huge. If all the

part deliveries or even half of them could have been prevented (if we think that there was enough materials in the case company stock) the readings would have been a lot smaller.

Big differencies among suppliers can partially be explained by the fact that some of the suppliers especially those who managed to deliver full batches without delays are located near case company, and therefore can deliver materials better. They can fill the trucks afternoon when suppliers located further away have to load the truck already during morning to be able to deliver materials during the same day. Nearby suppliers might use they own trucks when suppliers further away might have to use carriers. Using carriers usually takeas one extra day, since materials are droven via the distribution centre.

The amounts of one certain item one order contains have not been taken into account in these diagrams and in the orders suppliers confirmed deviantly. One order could contain several items and all of them were postponed or only one of them were postponed. Of course the suppliers try to perform and delive as good as possible to maintain good reliability of delivery and not consciously postpone whole order.

6.5 Why to improve case company- supplier communication

The biggest reason the case company needed better communication tools to communicate and share information with the suppliers was the uncertainty that lies there without it. Using JIT and Lean methods and having no visibility to the supplier buffer stocks enabled too great responsibility to the suppliers to control the production. One mistake in suppliers processes and consequently delays in delivery process compromises eventually the case company’s production.

When the case company have visibility to the suppliers buffer stock levels they could control the amounts better and prepare for possible stock outs or delivery problems beforehand. Visibility would not just benefit the case company, but the suppliers

also. They could have information and advices from the case company and together they could find a solution to the problems. Respectively the case company could give information about their inventory to the suppliers. This enables the suppliers better to focus on their bottleneck products, which generate problems. When the suppliers could see the case company stock levels to be sufficient for some part, they could concentrate to some other part which might run out or generate problems in the future, or which they otherwise would not be able to produce in time. Also the facts that visibility to the suppliers stock could enable the case company get rid of excessive stock and allow them to store materials directly to production line. This would lower the capital tied up in inventory.

Basic definition about visibility and the benefits it creates can be described as follows; If supply chains have visibility into demand, perfomance, deliveries, inventory levels etc. the total perfomance of the supply chain will improve.(Johansson & Melin)

Parts that create the most problems are not necessary complicated or expensive, but the availability of them is usually very weak. By controlling and having visibility to supplier stocks enables to detect the problems in time.

According to Kaipia, Holmström and Tanskanen (2002) survey made by European logistics association stated that the rate of late and incomplete deliveries have remained at very high level (appr. 10%) among European companies during last decade. These incomplete and late deliveries happen despite all the information and EDI systems available nowadays. Kaipia et al. mentions that great information system does not guarantee complete deliveries, but an effective process solution for how to transfer demand is equally important, and the point is that the order is an inefficient form of transferring information. Order is just the sign for supplier to react customer's immediate need, but the sign should have been sent already before the order, in a shape of material forecast. If the information is only transferred via purchase orders, problems will happen and supplier will not have any idea of future demand and they could have extremely big buffer stock for some items and extremely small for some other. This generates problems and could end up in the

situation where important materials will run out.

Delivery ability depends on the functionality of logistic process. This process depends on the fact how good companies can work together. If buyer will not be able to share its future demand beforehand, the short delivery time could mean to supplier big buffer stocks, and the costs related to stock might raise the prices. By having better and more reliable forecast, company could use that as advantage which could even lead to a situation where it can lower the material prices.

7 Results and improvement targets

Having no common forecast procedure and having no forecast at all makes it hard to suddenly discover one solution which would be perfect immediately. The fact that different end products are pushed into the production plan with few day notice increases the difficulty even more.

Every end product is different and they contain same items more or less. Inside one production line the variation is not that big, but when talking about different production lines the variation gets bigger.

In order to case company would be able to have information about the suppliers buffer stocks a simple excel form was made to help enquire the buffer stock levels. This form contains all certain suppliers' materials and the layout is taken from the contract. The idea behind this is that the case company buyers could send this form to the suppliers monthly or every second week, or the suppliers could send this information automatically. This would give real concrete information about the supplier's current stock levels.

This enables to prevent company from having stock outs and also to improve material forecasts. Together with material forecasts the case company and the suppliers could anticipate to future demand better. When the buyers actively

enquire stock levels, the suppliers cannot cover their production problems and the stock outs can be find out early enough.

The buyers could enquire the supplier's stock levels, by using existing forms and information's. The current contract contained already almost all necessary information related to products. It had the case company part numbers and materials name, as well as information related to buffer inventory. By modifying it, as in the figure 14 the inquiry of current buffer stock levels becomes easier.

Case company inventory	Supplier actual inventory	Difference between actual and min buffer	Next delivery
date: 14.8.2015	date: 13.8.2015		
10	10	-30	
10	6	-34	
10	45	15	
10	25	0	
10	9	-11	
3	9	-16	
6	50	25	
5	100	-200	
20	200	-100	
30	250	-50	
10	10	0	

Figure 13 Modification to existing contract

By using the existing form, which already contained all the items that the suppliers' delivered to the case company and the min/max stocks the inquiry becomes easier. The suppliers does not have to fill up every parts current situation, but the most important parts only. If the minimum stock is agreed to be for example 40pcs and the supplier actual inventory is currently 10 the difference column will generate the difference (which in this case would be 30) and the color (green or red) whether the difference is low or sufficient. Correspondingly the case company could send the same form to the supplier where case company has listed their inventory. This way both sides could see which products are about to run out.

The problems which may occur when sharing the current inventory levels such a way, is the possibility that the figures will not match the actual inventory. If the figures are taken from the ERP system there is a chance that the actual inventory is smaller or

bigger. This is because some materials sometimes are transferred to other production lines, but the transfer has forgotten to done in the ERP system. Materials also disappear due to reclamations and breakdowns and then the transfer should also be done in the ERP. It might be risky if the supplier's begin to plan their production according to the case company inventory levels. It is good that mutual visibility and information sharing allows companies to prioritize their production, but relying on that information too much could be a risk.

One example of good supplier relationship is the example provided in the attachment no.1. One significant supplier of the case company could provide a deviation report to give an overview about their current buffer stocks. The report contains names of the items and current size of the buffer stock. It also contains the targets for minimum and maximum buffer stocks. With the help of this simple report the case company could prevent possible delivery problems. The idea is the same like the one mentioned above (report made in the contract) but the supplier can run this by themselves, automatically through their ERP system. The information is the same and correspondingly the case company could send their current stock sizes to the supplier, to give them the information where to focus and what parts are about to run out. All the suppliers will not have the same possibility to send report like that, and instead they could use the report provided by the case company.

7.1 Creating visibility to material demand

Based on the analysis and conversation with the suppliers and the case company buyers the current situation of purchasing and forecasting and the problems related to it were clarified. The company has many suppliers and the reliability of delivery among them was very erratic. Lack of appropriate tools for communication and weak visibility in supply chain deteriorated the operations in both ends of the supply chain. Based on this information's the most critical improvement targets were chosen. The improvements should be done slowly, and at first focus on the most important suppliers only, or to suppliers with most difficulties to deliver in time.

7.2 Creating material need for end product

Since it turned out that the suppliers needed to know the case company future demand in part level, it was important to find this information and to modify it to serve every supplier separately and modify it, so the suppliers could read it easily.

The information was taken from the case company's ERP system. The data was then transferred from ERP to Excel. The data contained all the materials needed for produce one certain type end product. The most complicated products include around 700 different parts. When the data was in Excel it was needed to modify it so that every part could be linked to a certain supplier. This was done by finding matches between the contracts and the list transferred from ERP. Five biggest suppliers were taken to this precursory example, but the Excel is in form that it could be expanded with more suppliers anytime with minor work.

When all the data was in place in Excel, it searched matches between the supplier-case company contracts and Manufacturing order and returned matches between these lists and shows how many pieces of one certain item is needed for one certain end-product. Part of the list is visible on figure 14. This information had not been available earlier and it gives much value to the suppliers when they know the exact demand for every material separately.

Code (case company)	Part	quantity/assembly
205380	ROTATING UNIT FRAME ASSEMBLY	1
205339	CIRCUIT BOARD PLATE, RIVETED	1
208165	WALL MOUNTING ASSEMBLY	1
203876	SENSOR TAIL FRAME	1
204241	COLUMN LOWER BACK COVER	1
204397	PSU EMC PLATE 2	1
204238	COLUMN UPPER BACK COVER	1
203389	CIRCUIT BOARD PLATE ASSEMBLY	1
203891	EMC COVER	1
203387	PANEL PLATE ASSY	1
205555	PACKAGE SUPPORT BACK	2
204292	LOWER SHELF COLLUM COVER	1
204399	MIRROR PLATE	1
206912	FAN SUPPORT	1

Figure 14 Supplier no.1000672 materials needed for end product X

The data now shows one specific supplier materials needed for one specific end product. Total of 53 different parts from supplier no. 1000672 is needed to that specific end product. The amount of total parts needed to that end product is 625pcs. If four biggest suppliers are taken, the total amount of parts is 86.

When material information from all the end products were gathered, the information was joined together in a way that every end product from certain production line was in the same excel sheet. All the end products and the specific suppliers' materials needed for these products can now be seen in one view. This is illustrated in figure 15.

Week 13.8.2015	33
New orders	**Quantity**
End product A	3
End product B	0
End product C	1
End product D	0
End product E	2
End product F	0
End product G	0
End product H	0
End product I	0
End product J	0
End product K	0
End product L	0

Code(case company	Part	quantity/assembly	total demand
204328	FASTENING COLLAR	2	12
204451	3PH DRIVER HOLDER	2	12
204060	MICROSWITCH PLATE	2	12
211831	RACK	2	8
205339	CIRCUIT BOARD PLATE, RIVETED	1	6
208165	WALL MOUNTING ASSEMBLY	1	6
205778	EMC COVER PLATE	1	6
203856	MAIN CABLE ANCHOR PLATE	1	6
205554	PACKAGE SUPPORT FRONT	1	6
203890	CPU MOUNTING PLATE	1	6
205480	CABLE CHANNEL	1	6
204398	PSU EMC PLATE 1	1	6
204366	POWER SWITCH AND FUSE PLATE	1	6
204601	OPTOSENSOR SUPPORT	1	6
207013	SWITCH CLAMP	1	6

Figure 15 one production line material need for one certain supplier

From the starting point where the only information concerning material need was given in a form of end products which in most cases did not tell a think to the suppliers, the new method should help the suppliers to anticipate future need better.

The method created will be useful since when the case company receives new orders, they could run the Excel file and share the information with the suppliers, even immediately if wanted. When the suppliers see that the demand of certain products is growing and purchase order is more likely to come, they could already start their production to keep sufficient buffer stocks and deliver materials in time. This would also solve the problem with the minimum buffer. Usually one delivery

batch from the suppliers are the size of a minimum-buffer. If the suppliers keeps only minimum buffer, they will always have a problem that there are no items in the buffer stock.

This kind of information could be more important to the suppliers who are known for their delivery problems. When they can receive concrete information about coming demand, they might start to deliver better and without delays. By giving concrete view about demand, enables your suppliers to deliver and produce materials to buffer.

The problem which still created problems was forecasting. The table kind of information introduced would be necessary to the suppliers in weeks advance. The problem was that future weekly plan was very variable and the plan varies a lot during the time period. By using either average demand or some other more accurate forecast method such as exponential smoothing the case company could give more directional demand signals to the suppliers. When the case company starts to receive orders from their customers, the case company should inform their suppliers with more specific demand information. When the precise demand is known they could give this information in material level.

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7.3 Communication tool

One part of the work was to find efficient and cost-effective platform where all the information discussed could be shared, before the actual implementation of new software takes place. Many IT-companies offer platforms where this kind of information could easily be shared, but due to high costs new software or updating existing software at the time was not an option. This was not necessarily a bad thing, since as already mentioned in this thesis; many expensive implementations have failed to bring value to the company, and often the information is more important than the channel. Due to these restrictions only possible option was some kind of cloud computing or transferring information via e-mail. Although it is always a security risk to store and transmit information in cloud based systems, but since the

security has increased and most confidential information will not be the shared, it will not be a problem. Transmitting information through e-mail and sharing Excel sheets is not the best way to work. Moreover the fact that it is hard to save information in one place, when it is transferred through e-mail. E-mail could work with few suppliers, but when the range of suppliers increases the lack of appropriate storage becomes a problem.

The new system should have function where information could be stored and where it can be founded later. Both the case company and the suppliers should have access to that information and they could add and read the contents in that database.

The information shared in the database would concern the material need, supplier buffer stocks and other related issues. The case company has internal cloud system which could be used to share this information. Selected people outside the case company could have access to the cloud system, for example by giving them a certain password. This would be cost effective way to use already existing platform. Everybody who would receive the password would have access to it.

Other suggestion which would need more investigation and consultation from ERP-provider would be that the suppliers would have restricted access to the case company ERP-system. Alternatively certain areas from the ERP-system could be released to the suppliers. The suppliers could then find their information by using certain ID. They could have access for example to the case company manufacturing plan and to the material need. By using their own ID they could see information provided just for them.

8. Conclusions

Thesis was done to find ways to improve the visibility and communication related to the case company future demand and the supplier's buffer stocks and to examine the most relevant information these sides should share. When the thesis moved on the current problems were clarified and also other problems that were faced were

solved and solutions to these problems were given. The reasons why the case company wanted information about the suppliers' buffer stocks was the suppliers that could not deliver on time and constantly delivered incomplete orders. This problem was confirmed when the current problems were clarified and when people were interviewed. The biggest problems were easy to find out from the case company employees and from one main supplier. Authors own experience in the company also made it easier to identify the problems.

Based on the findings the most important improvement targets were chosen. These were the material need product-specific and visibility to the supplier's buffer stock. Also by highlighting the importance of cooperation was one kind of solution and improvement. The Excel file which tells the material need product-specific for every supplier separately is useful and the fact that this information has not been available earlier makes it useful to the case company when they now can tell the suppliers the demand more accurately. Although it only contains five suppliers, it is easy to expand the file to contain more suppliers. The Excel file has to be only updated when new parts are taken into use or when supplier of some certain material is changed.

The earlier the suppliers would get the demand information from the case company the better they could anticipate for future demand. The ideal situation would be that the case company could send the demand information two/three weeks beforehand, so the suppliers would have the time to react. As mentioned earlier in thesis; order is an inefficient sign of transferring information. Order is just the sign for supplier to react customer's immediate need, but the sign should have been sent already before the order, in a shape of material forecast. To maximize the benefits, ideal situation would be that the case company concentrates to find integral forecast process, which would benefit both themselves and the suppliers. Cooperation could be done with the suppliers to find bottlenecks and improve responsiveness of all parties.

The forecast process and practices was also reviewed in this thesis. Since implementing a new forecast procedure was not the main subject and main idea of the thesis and the fact that the field of the subject and the data behind it to get reliable information is big, only few simple examples were given to clarify the

forecast process in industry in general. To implement a new forecast procedure for the company would be a subject for a whole new thesis.

If the case company decides to implement or update its current software to share information related to materials, this thesis expedites and gives facts where to concentrate. The material need product-specific is at stage where it could be already used. When the forecast procedure is also updated and streamlined, together this information makes the suppliers activity more reliable.

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Appendices

Appendix 1. Deviation report from supplier

Deviations in supplier buffer

Alert	Material	Name			Current	Target min	Target max	% min	% max
RED	xxx	L COVER, STEEL			0	120	600	0,00	0,00
RED	xxxx	A FRAME	L-PLATE KIT	A	0	18	42	0,00	0,00
RED	xxxx	A BOTTOM KIT 2	ACS800 R8 IP21		0	30	60	0,00	0,00
RED	xxxxx	H COVER, STEEL			0	120	600	0,00	0,00
RED	xxxx	A R8 CART COVERS	ACS800 R8		0	28	56	0,00	0,00
RED	xxx	K SIDE PLATE, STEEL			0	38	190	0,00	0,00
RED	xxx	F INSULATING SHEET, PLASTIC			0	100	300	0,00	0,00
yellow	xxx	C BUS BAR, CU			211	250	650	84,40	32,46
yellow	xxxx	A STRIP, STEEL			92	100	400	92,00	23,00
light blue	xxxx	E BUS BAR, CU			41	20	40	205,00	102,50
light blue	xxxx	B INSULATING SHEET, PLASTIC			206	100	200	206,00	103,00
light blue	xxx	E BUS BAR, CU			318	150	300	212,00	106,00
light blue	xxx	A BUS BAR, CU			214	100	200	214,00	107,00
light blue	xxx	A BUS BAR, CU			219	100	200	219,00	109,50
light blue	xx	B BR. OUTPUT BUSBAR	ACS800 R7-02/04		49	20	40	245,00	122,50
BLUE	xxx	A BUSBAR SHROUD	ACS800-04		25	10	20	250,00	125,00
BLUE	xxxx	D BUS BAR, CU			284	100	200	284,00	142,00

Appendix 2. Survey for buyers

Current problems related to suppliers buffer stocks and case company forecast?

Some other problem related to this?

How often do you face a situation that supplier doesn't have agreed buffer stocks and deliveries will arrive late?

How often does this cause extra work to you/production?

Do the late shortages cause some quick actions?

How would the visibility to suppliers stocks affect to your work and what would it change?

Does some certain supplier stand out? Why?

Appendix 3. Material need for end products